```
(%i13) kill(all);
(%o0) done
```

```
(%i1) assume(alpha>0,epsilon>0,c>0,m>0);
(%o1) [α>0,ε>0,c>0,m>0]
```

# 1 Eq.(12)

```
(%i2) E12: drdth = drdth0/sqrt(1-(L0/(m*c*r^2))^2*(drdth0^2+r^2));
```

$$(\%o2)\quad drdth=\frac{drdth0}{\sqrt{1-\frac{(r^2+drdth0^2)\,L0^2}{c^2\,m^2\,r^4}}}$$

# 2 dr/dtheta

```
(%i3) r: alpha/(1+epsilon*cos(theta));
```

$$(\%o3)\quad \frac{\alpha}{\varepsilon\cos(\theta)+1}$$

```
(%i4) drdth0: diff(r,theta);
```

$$(\%o4)\quad \frac{\alpha\,\varepsilon\sin(\theta)}{(\varepsilon\cos(\theta)+1)^2}$$

```
(%i5) r^2*epsilon/alpha*sin(theta);
```

$$(\%o5)\quad \frac{\alpha\,\varepsilon\sin(\theta)}{(\varepsilon\cos(\theta)+1)^2}$$

# 3 Eq.(15)

```
(%i6) kill(r);
(%o6) done
```

```
(%i7) assume(r>0);
(%o7) [r>0]
```

```
(%i8) drdth0: epsilon*r^2/alpha*sin(theta);
```

$$(\%o8)\quad \frac{\varepsilon\,r^2\sin(\theta)}{\alpha}$$

```
(%i12) E15: ev(E12,eval);
```

$$(\%o12)\quad drdth=\frac{\varepsilon\,r^2\sin(\theta)}{\alpha\sqrt{1-\frac{\left(\frac{\varepsilon^2\,r^4\sin(\theta)^2}{\alpha^2}+r^2\right)L0^2}{c^2\,m^2\,r^4}}}$$

```
(%i13) ratsimp(%);
```

$$(\%o13)\quad drdth = \frac{c\,\varepsilon\,m\,r^3\sin(\theta)}{\sqrt{\alpha^2\,c^2\,m^2\,r^2 - (\varepsilon^2\,r^2\sin(\theta)^2 + \alpha^2)\,L0^2}}$$